

What is claimed is:

1. A system comprising:
- 2 means for obtaining a parent matrix, N^M , the parent matrix being a first moment matrix of a parent model, the parent matrix having elements, $n_{i,j}^M$, i and j being indices of the parent matrix, the parent matrix having first-row elements, $n_{1,j}^M$, the parent matrix further having diagonal elements $n_{j,j}^M$;
- 5 means for obtaining a child matrix, N^S , the child matrix being a first moment matrix of a child model, the child model being a submodel within the parent model, the child matrix having elements, $n_{k,l}^S$, k and l being indices of the child matrix, the child matrix having first-row elements, $n_{1,k}^S$, the child matrix further having diagonal elements, $n_{k,k}^S$;
- 10 means for determining an expanded matrix, N^F , the expanded matrix being a first moment matrix of the child model instantiated within the parent model, the means for determining the expanded matrix comprising:
- 14 means for calculating a first set of first-row elements, $n_{1,j}^F$, for the expanded matrix, the first set of first row elements being calculated according to:

$$n_{1,j}^F = n_{1,j}^M;$$
- 17 means for calculating a second set of first-row elements, $n_{1,k}^F$, for the expanded matrix, the second set of first row elements being calculated according to:

$$n_{1,k}^F = n_{1,S}^M n_{1,k}^S;$$

20 means for calculating a first set of diagonal elements, $n_{j,j}^F$, for the expanded matrix,
21 the first set of diagonal elements being calculated according to:

22 $n_{j,j}^F = n_{j,j}^M$; and

23 means for calculating a second set of diagonal elements, $n_{k,k}^F$, for the expanded
24 matrix, the second set of diagonal elements being calculated according to:

25 $n_{k,k}^F = n_{k,k}^S + (n_{S,S}^M - 1) \cdot n_{i,k}^S$.

1 2. A method comprising the steps of:
 2 obtaining a parent matrix, N^M , the parent matrix being a first moment matrix of a parent
 3 model, the parent matrix having elements, $n_{i,j}^M$, i and j being indices of the parent
 4 matrix, the parent matrix having first-row elements, $n_{1,j}^M$, the parent matrix further
 5 having diagonal elements $n_{j,j}^M$;
 6 obtaining a child matrix, N^S , the child matrix being a first moment matrix of a child model,
 7 the child model being a submodel within the parent model, the child matrix having
 8 elements, $n_{k,l}^S$, k and l being indices of the child matrix, the child matrix having
 9 first-row elements, $n_{1,k}^S$, the child matrix further having diagonal elements, $n_{k,k}^S$;
 10 and
 11 determining an expanded matrix, N^F , the expanded matrix being a first moment matrix of
 12 the child model instantiated within the parent model, the step of determining the
 13 expanded matrix comprising the steps of:
 14 calculating a first set of first-row elements, $n_{1,j}^F$, for the expanded matrix, the first
 15 set of first row elements being calculated according to:
 16
$$n_{1,j}^F = n_{1,j}^M;$$

 17 calculating a second set of first-row elements, $n_{1,k}^F$, for the expanded matrix, the
 18 second set of first row elements being calculated according to:
 19
$$n_{1,k}^F = n_{1,S}^M n_{1,k}^S;$$

20 calculating a first set of diagonal elements, $n_{j,j}^F$, for the expanded matrix, the first
 21 set of diagonal elements being calculated according to:

22 $n_{j,j}^F = n_{j,j}^M$; and

23 calculating a second set of diagonal elements, $n_{k,k}^F$, for the expanded matrix, the
 24 second set of diagonal elements being calculated according to:

25 $n_{k,k}^F = n_{k,k}^S + (n_{S,S}^M - 1) \cdot n_{1,k}^S$.

1 3. In a system having a parent matrix, N^M , and a child matrix, N^S , the parent
 2 matrix being a first moment matrix of a parent model, the parent matrix having elements,
 3 $n_{i,j}^M$, i and j being indices of the parent matrix, the parent matrix having first-row elements,
 4 $n_{1,j}^M$, the parent matrix further having diagonal elements $n_{j,j}^M$, the child matrix being a first
 5 moment matrix of a child model, the child model being a submodel within the parent
 6 model, the child matrix having elements, $n_{k,l}^S$, k and l being indices of the child matrix, the
 7 child matrix having first-row elements, $n_{1,k}^S$, the child matrix further having diagonal
 8 elements, $n_{k,k}^S$, a method comprising the steps of:

9 calculating a first set of first-row elements, $n_{1,j}^F$, for an expanded matrix, the
 10 expanded matrix being a first moment matrix of the child model instantiated within the
 11 parent model, the first set of first row elements being calculated according to:

12 $n_{1,j}^F = n_{1,j}^M$;

13 calculating a second set of first-row elements, $n_{1,k}^F$, for the expanded matrix, the
 14 second set of first row elements being calculated according to:

15
$$n_{1,k}^F = n_{1,S}^M n_{1,k}^S ;$$

16 calculating a first set of diagonal elements, $n_{j,j}^F$, for the expanded matrix, the first
 17 set of diagonal elements being calculated according to:

18
$$n_{j,j}^F = n_{j,j}^M ; \text{ and}$$

19 calculating a second set of diagonal elements, $n_{k,k}^F$, for the expanded matrix, the
 20 second set of diagonal elements being calculated according to:

21
$$n_{k,k}^F = n_{k,k}^S + (n_{S,S}^M - 1) \cdot n_{1,k}^S .$$

1 4. A method comprising the steps of:

2 obtaining elements of a parent matrix, N^M , the parent matrix being a first moment
 3 matrix of a parent model;

4 obtaining elements of a child matrix, N^S , the child matrix being a first moment
 5 matrix of a child model, the child model being a submodel within the parent model;

6 determining elements of an expanded matrix, N^F , the expanded matrix being a first
 7 moment matrix of a flattened model, the flattened model representing an instantiation of
 8 the child model within the parent model, the elements of the expanded matrix being
 9 determined as a function of the elements of the parent matrix and the elements of the child
 10 matrix.

1 5. The method of claim 4, wherein the step of obtaining elements of the parent
 2 matrix comprises the steps of:

3 obtaining first-row elements, $n_{1,j}^M$, of the parent matrix; and
 4 obtaining diagonal elements, $n_{j,j}^M$, of the parent matrix.

1 6. The method of claim 5, wherein the step of obtaining elements of the child
 2 matrix comprises the steps of:

3 obtaining first-row elements, $n_{1,k}^S$, of the child matrix; and
 4 obtaining diagonal elements, $n_{k,k}^S$, of the child matrix.

1 7. The method of claim 6, wherein the step of determining elements of the
 2 expanded matrix comprises the step of:

3 calculating a first set of first-row elements, $n_{1,j}^F$, for the expanded matrix, the first
 4 set of first row elements being calculated according to:

5
$$n_{1,j}^F = n_{1,j}^M.$$

1 8. The method of claim 6, wherein the step of determining elements of the
 2 expanded matrix comprises the step of:

3 calculating a second set of first-row elements, $n_{1,k}^F$, for the expanded matrix, the
 4 second set of first row elements being calculated according to:

5
$$n_{1,k}^F = n_{1,S}^M n_{1,k}^S.$$

1 9. The method of claim 6, wherein the step of determining elements of the
2 expanded matrix comprises the step of:

3 calculating a first set of diagonal elements, $n_{j,j}^F$, for the expanded matrix, the first
4 set of diagonal elements being calculated according to:

5
$$n_{j,j}^F = n_{j,j}^M.$$

1 10. The method of claim 6, wherein the step of determining elements of the
2 expanded matrix comprises the step of:

3 calculating a second set of diagonal elements, $n_{k,k}^F$, for the expanded matrix, the
4 second set of diagonal elements being calculated according to:

5
$$n_{k,k}^F = n_{k,k}^S + (n_{S,S}^M - 1) \cdot n_{1,k}^S.$$

1 11. In a system having hierarchically-nested processes, a method comprising
2 the steps of:
3 obtaining a parent matrix, the parent matrix being a first moment matrix of a parent
4 process, the parent matrix having parent elements;
5 obtaining a child matrix, the child matrix being a first moment matrix of a child
6 process, the child process being nested within the parent process, the child matrix having
7 child elements; and
8 calculating elements of an expanded matrix, the expanded matrix being a first
9 moment matrix of a model, the model representing the child model instantiated within the
10 parent model, the elements of the expanded matrix being calculated as a function of the
11 child elements and the parent elements.

1 12. A system comprising:
2 logic configured to obtain a parent matrix, the parent matrix being a first moment
3 matrix of a parent process, the parent matrix having parent elements;
4 logic configured to obtain a child matrix, the child matrix being a first moment
5 matrix of a child process, the child process being nested within the parent process, the
6 child matrix having child elements; and
7 logic configured to calculate elements of an expanded matrix, the expanded matrix
8 being a first moment matrix of a model, the model representing the child model
9 instantiated within the parent model, the elements of the expanded matrix being calculated
10 as a function of the child elements and the parent elements.

1 13. In a system having a parent matrix, N^M , and a child matrix, N^S , the parent
 2 matrix being a first moment matrix of a parent model, the parent matrix having elements,
 3 $n_{i,j}^M$, i and j being indices of the parent matrix, the parent matrix having first-row elements,
 4 $n_{1,j}^M$, the parent matrix further having diagonal elements $n_{j,j}^M$, the child matrix being a first
 5 moment matrix of a child model, the child model being a submodel within the parent
 6 model, the child matrix having elements, $n_{k,l}^S$, k and l being indices of the child matrix, the
 7 child matrix having first-row elements, $n_{1,k}^S$, the child matrix further having diagonal
 8 elements, $n_{k,k}^S$, a system comprising:

9 logic configured to calculate a first set of first-row elements, $n_{1,j}^F$, for an expanded
 10 matrix, the expanded matrix being a first moment matrix of the child model instantiated
 11 within the parent model, the first set of first row elements being calculated according to:

$$12 \quad n_{1,j}^F = n_{1,j}^M;$$

13 logic configured to calculate a second set of first-row elements, $n_{1,k}^F$, for the
 14 expanded matrix, the second set of first row elements being calculated according to:

$$15 \quad n_{1,k}^F = n_{1,S}^M n_{1,k}^S;$$

16 logic configured to calculate a first set of diagonal elements, $n_{j,j}^F$, for the expanded
 17 matrix, the first set of diagonal elements being calculated according to:

$$18 \quad n_{j,j}^F = n_{j,j}^M; \text{ and}$$

19 logic configured to calculate a second set of diagonal elements, $n_{k,k}^F$, for the
20 expanded matrix, the second set of diagonal elements being calculated according to:

21

$$n_{k,k}^F = n_{k,k}^S + (n_{S,S}^M - 1) \cdot n_{i,k}^S.$$

1 14. A computer-readable medium comprising:
2 computer-readable code adapted to instruct a programmable device to obtain
3 elements of a parent matrix, N^M , the parent matrix being a first moment matrix of a parent
4 model;

5 computer-readable code adapted to instruct a programmable device to obtain
6 elements of a child matrix, N^S , the child matrix being a first moment matrix of a child
7 model, the child model being a submodel within the parent model;

8 computer-readable code adapted to instruct a programmable device to determine
9 elements of an expanded matrix, N^F , the expanded matrix being a first moment matrix of a
10 flattened model, the flattened model representing an instantiation of the child model within
11 the parent model, the elements of the expanded matrix being determined as a function of
12 the elements of the parent matrix and the elements of the child matrix.

1 15. The computer-readable medium of claim 14, further comprising:
2 computer-readable code adapted to instruct a programmable device to obtain first-
3 row elements, $n_{1,j}^M$, of the parent matrix; and
4 computer-readable code adapted to instruct a programmable device to obtain
5 diagonal elements, $n_{j,j}^M$, of the parent matrix.

1 16. The computer-readable medium of claim 15, further comprising:
2 computer-readable code adapted to instruct a programmable device to obtain first-
3 row elements, $n_{1,k}^S$, of the child matrix; and
4 computer-readable code adapted to instruct a programmable device to obtain
5 diagonal elements, $n_{k,k}^S$, of the child matrix.

1 17. The computer-readable medium of claim 16, further comprising:
2 computer-readable code adapted to instruct a programmable device to calculate a
3 first set of first-row elements, $n_{1,j}^F$, for the expanded matrix, the first set of first row
4 elements being calculated according to:

5
$$n_{1,j}^F = n_{1,j}^M.$$

1 18. The computer-readable medium of claim 16, further comprising:
2 computer-readable code adapted to instruct a programmable device to calculate a
3 second set of first-row elements, $n_{1,k}^F$, for the expanded matrix, the second set of first row
4 elements being calculated according to:

5
$$n_{1,k}^F = n_{1,S}^M n_{1,k}^S.$$

1 19. The computer-readable medium of claim 16, further comprising:
2 computer-readable code adapted to instruct a programmable device to calculate a
3 first set of diagonal elements, $n_{j,j}^F$, for the expanded matrix, the first set of diagonal
4 elements being calculated according to:

5
$$n_{j,j}^F = n_{j,j}^M.$$

1 20. The computer-readable medium of claim 16, further comprising:
2 computer-readable code adapted to instruct a programmable device to calculate a
3 second set of diagonal elements, $n_{k,k}^F$, for the expanded matrix, the second set of diagonal
4 elements being calculated according to:

5
$$n_{k,k}^F = n_{k,k}^S + (n_{S,S}^M - 1) \cdot n_{1,k}^S.$$